

about 22 per cent too high, and when the instrument is adjusted to record correctly at the most frequent or average velocities, by changing the factor to 2.65, its rate is still 6 per cent too high at 25 miles an hour and 9 per cent too high at 100 miles an hour. Velocities indicated by the new standard are about 2 per cent too high at 25 miles an hour and 5 per cent too high at 100 miles an hour; as indicated in the Table 4, when the old standard is properly adjusted and indicates a velocity of 50, the true velocity is 46; when the new standard indicates 50 miles an hour, the true velocity is 48, etc.

It is expected that the new standard will be adopted as soon as instruments now in use can be modified and replaced. A description, including plans of the new anemometer, is in preparation for use by anyone interested in the operation or manufacture of these instruments.

#### WHY HARDWOODS DO NOT GROW NATURALLY IN THE WEST

By J. A. LARSEN, Forest Examiner

[Excerpts from *The Idaho Forester*, annual, 1922, 4: 28-32]

Unfortunately the beautiful hardwood trees which are native to the Eastern States do not grow naturally in the West. We have here only aspen, cottonwood, small birch, hawthorns, cherry, and alder. On the Pacific coast are oak and maple, but limited largely to lower moist sites such as streams bed and canyons. The general absence of broad leaf trees in the West is most likely due to the difference in precipitation and temperature between the East and West. To be sure, there are other factors which limit the distribution of trees, such as soil acidity, alkalinity, soil and atmospheric moisture, as well as inherent qualities in the plants themselves. Soil acidity and soil moisture or quality of the soil can at best be of significance only within a limited area, and since it has been shown, except for areas near the sea, that atmospheric moisture varies according to the precipitation, it is only a result and, as such, not a controlling factor. Internal structure of leaves and stems, ability to transport much water, injuries by frost, etc., must be looked upon as direct results of the plant's environment rather than factors which control their distribution. There remains, therefore, the factors of temperature and precipitation and the variation and extremes of these worthy of consideration.

Air temperature, though it may not in all cases be a controlling factor, often limits the distribution of trees either by too short, too cold summer weather and frosts during the growing season, or by too great extremes. Experiments have shown that the leaves of trees do not become green in temperatures above 104° F. and do not function below 40° F. Unusually low temperatures may cause root killing, bark and wood splitting, and killing of buds and stems of hardwood.

If the growing season is too short, the species which are introduced from a warmer climate bud out too early in the spring, or have no time to form sufficient wood in the new stems to withstand frost injuries in the fall. If the nights are too cold throughout the summer months, one of the plant foods, sugar, which is not injured by freezing, has not had time to form before the cold weather sets in. The plant food is therefore chiefly in the form of starch, which is damaged by frost.

From the standpoint of water requirement of trees, it is well to note that the structure of the leaves, stems, and wood of trees may render some entirely unsuitable for certain climates, especially in regions characterized by dry summer air and low rainfall. Deciduous trees

are able to transport much more water than conifers. Dr. Franz R. von Hohnel, of the Austrian Forest Experiment Station, determined by careful tests over a period of 12 years that 1 acre of oak forest lost by transpiration from 2,227 to 2,672 gallons of water per day during periods of growth. This is equal to 2.9 to 3.9 inches of rainfall per month for the growing season—much more than occurs over the western sections of the United States. Other broad-leaved trees are much like oak in respect to evaporation of water.

An examination of the distribution of hardwoods in the Eastern States shows that their general northern limit follows a line through St. Paul, Minn., to Eau Claire and Sheboygan, Wis.; Grand Rapids, Lansing, and Detroit, Mich. North of this line the forest is predominantly coniferous. From Detroit to central New York an inversion occurs in that the hardwoods are on the north and the conifers to the south. This is evidently due to low land and relatively warm air surrounding the Lakes and the higher land with colder air to the south. From central New York the line goes northeast through western Massachusetts, through Concord, N. H., and Augusta, Me., with conifers on the north and hardwoods to the south. The westward extension of the hardwoods is defined by the Mississippi River from St. Paul to Rock Island, Ill., thence southwestward through Iowa, Kansas, and Oklahoma, irregularly, according to local variations in topography.

In conclusion it may be said that precipitation and atmospheric moisture over the western United States are insufficient for the eastern hardwoods. Air temperature is suitable in most towns and cities and over extensive farming sections. This makes it possible by irrigation or by planting in certain very favorable sites such as moist slopes and aspects sheltered from the driving summer winds, to raise eastern hardwoods in the Pacific Northwest. Except for southern Idaho and the Pacific coast cities, however, the frequent frost which occurs over most of the region during late spring and early fall are a serious drawback, which stunts and kills back the young trees and retards growth on the mature trees.

[Charts showing the mean air temperature and rainfall for different eastern and western cities accompany the article showing the distinction spoken of in the text.]

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#### TEMPERATURE SUMMATIONS WITH REFERENCE TO PLANT LIFE

By G. A. PEARSON, Director

[Fort Valley Forest Experiment Station]

Plant investigators are seeking an index of temperature which is expressive of the heat conditions required by plants. The mean temperature generally employed by meteorologists and too often by biologists is misleading when applied in the vegetable world. Plants are far less concerned with the relatively low night temperatures than with the more effective temperatures prevailing during the hours of daylight. For this reason a mean which gives equal weight to night and day temperatures is a poor measure of the heat available for maintaining the physiological processes involved in plant life. The inadequacy of mean temperature is very evident in the mountain forests of the Southwest, where an extremely high daily range is the rule and where the native vegetation experiences little discomfort from low night temperatures even to the point of frost, but is exceedingly dependent upon heat energy for carrying on photosynthesis.